

No of Pages : 3

Course Code: 08P401

Roll No:

(To be filled in by the candidate)

PSG COLLEGE OF TECHNOLOGY, COIMBATORE - 641 004

SEMESTER EXAMINATIONS, AUGUST / SEPTEMBER - 2014

BE / BE(SW) - PRODUCTION ENGINEERING Semester: 4

08P401 - FLUID MECHANICS AND MACHINERY

Time: 3 Hours

Maximum Marks: 100

INSTRUCTIONS:

1. Group I and Group II questions should be answered in the Main Answer Book.
2. Answer any **FIVE** questions in Group II.
3. Answer **ALL** questions in Group I and Group III.
4. Group III – **Multiple Choice questions** - (which will be given to the candidates half an hour before the scheduled close of the examination) **should be answered only** in the space provided **in the Main Answer Book.**
5. **Moody's Chart, Fluid properties and Minor loss coefficient tables are permitted**

GROUP I

Marks: 10 x 3 = 30

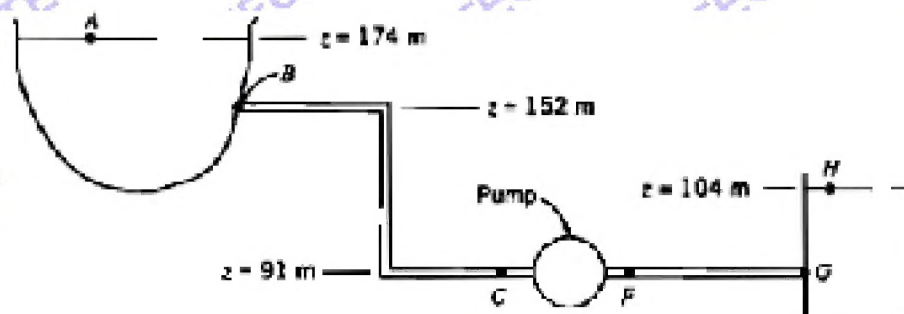
1. State Navier - Stokes equation.
2. Define capillarity.
3. Define streamline and path line.
4. The absolute pressure in a liquid of constant density doubles when the depth is doubled. State true or false and justify the answer.
5. What are the basic assumptions in the derivation of Bernoulli's equation?
6. Write the primary dimensions of a. power b. universal ideal gas constant R_u .
7. If velocity distribution in laminar boundary layer over a flat plate is assumed to be a second order polynomial $u = a+by+cy^2$, determine the constants using necessary boundary conditions.
8. Define equivalent length for minor loss in pipe flow. How is it related to minor loss coefficient?
9. Choose whether the following statement is true or false and justify the answer. "At the pump's free delivery efficiency of the pump is zero".
10. Draw the inlet and outlet velocity diagram of Impulse turbine.

GROUP II

Marks: 5 x 12 = 60

11. Derive the steady flow energy equation.
12. A conical pipe 10 cm inlet diameter, 20 cm outlet diameter and 100 cm long is placed horizontally. The velocity over any cross section may be considered to be uniform. Determine the local and convective acceleration at a section where the diameter is 15 cm for the following cases: a) constant inlet discharge of $0.2 \text{ m}^3/\text{s}$. b) inlet discharge varying linearly from $0.2 \text{ m}^3/\text{s}$ to $0.4 \text{ m}^3/\text{s}$ over 2 seconds. The time of interest is at $t=1$ second.

13. A large reservoir supplies water for a community. A portion of the water supply system is shown below. Water is pumped from the reservoir to a large storage tank before being sent on to the water treatment facility. The system is designed to provide 1310 L/s of water at 20°C. From B to C, the system consists of a square edged entrance, 760m of pipe, 3 fully open gate valves, four 45° elbows and two 90° elbows. Gauge pressure at C is 197 kPa. The system between F and G contains 760 m of pipe, two fully open gate valves and four 90° elbows. The pipe is made of cast iron and 508 mm in diameter throughout. Calculate
- average velocity in the pipe
 - gauge pressure at F
 - power input to the pump. Take efficiency of the pump as 80%.



14. A Kaplan turbine develops 24.65 MW power at an average head of 39 m, assuming a speed ratio of 2, flow ratio of 0.6, diameter of the boss equal to 0.35 times the diameter of the runner and an overall efficiency of 90%, calculate the diameter and speed of the turbine.
15. Air is flowing over a smooth flat plate with a velocity of 12 m/s. the length of the plate is 1.1 m and width 0.9 m. if laminar boundary layer exists up to a value of 2×10^5 , and kinematic viscosity of air is 0.15 stokes, find a. the maximum distance from the leading edge upto which laminar boundary layer exists; b. maximum thickness of boundary layer.
16. The fluid dynamic characteristics of a golf ball are to be tested using a model in a wind tunnel. Dependent parameters are drag force and lift force on the ball. The independent parameters should include angular speed ω , dimple depth d , ball diameter D , velocity V , density ρ and viscosity μ . Using method of repeating variables, determine suitable dimensionless parameters and express the functional dependence among them. A golf pro can hit a ball at 73 m/s and $\omega = 300\pi$ r/s. to model these conditions in a wind tunnel with maximum speed of 24 m/s, what model diameter should be used? What should be the angular velocity of the model if the diameter of the standard golf ball is 42.6 mm?

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Write the Alphabet of your choice answer for each question in the space provided in the Main Answer Book
(Do not attach this question paper along with the Main Answer Book)

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08P401 FLUID MECHANICS AND MACHINERY**GROUP III****Marks: 10 x 1 = 10**

- I) A flow in which each liquid particle has a definite path and their paths do not cross each other is called
A) steady flow B) uniform flow C) streamline flow D) turbulent flow
- II) Cavitation is caused by
A) high velocity B) low barometric pressure
C) high pressure D) low pressure
- III) In a turbulent flow in a pipe
A) shear stress varies linearly with radius
B) fluid particles move in straight lines
C) head loss varies linearly with flow rate
D) Reynolds number is greater than 10000
- IV) Flow occurring in a pipe line when a valve is being opened is
A) steady B) unsteady C) laminar D) vortex
- V) Non uniform flow occurs when
A) direction and magnitude of velocity at all points are identical
B) velocity of successive fluid particles at any point is same at successive periods of time
C) magnitude and direction of velocity do not change from point to point in the fluid
D) velocity, pressure changes from point to point in the fluid
- VI) To replace a compound pipe by a new pipe, the pipes will be equivalent when both the pipes have same
A) length and flow rate B) diameter and flow rate
C) head loss and flow rate D) length and head loss
- VII) If cohesion between molecules of a fluid is greater than adhesion between fluid and glass, then the free level of fluid in a dipped glass tube will be
A) higher than the surface of the liquid B) same as the surface of the liquid
C) lower than the surface of the liquid D) unpredictable
- VIII) Surface tension
A) decreases with fall in temperature
B) is also known as capillarity
C) is a function of the curvature of the interface
D) acts in the plane of interface normal to any line in the surface
- IX) In series pipe application
A) energy gradient remains same through all the pipes
B) hydraulic gradient remains same through all the pipes
C) head loss is same through all the pipes
D) total head loss is the sum of individual head loss through each pipe
- X) Atmospheric pressure held in terms of water column is
A) 7.5 m B) 10.30 m C) 9.81 m D) 8.5 m